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APPLICATION

FOR

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TITLE: LABELLING APPARATUS AND METHOD

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LABELLING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for labelling products.

Products to be sold are commonly labelled. In this regard, automatic labelling apparatus may be employed where the products are smaller and processed in large volumes. One approach in this regard is to wipe a label onto each product as its passes a labelling head. This approach, however, is only well suited for labelling products of uniform dimensions. Where products have irregular dimensions, such that the distance between a given product and the labelling head will vary, tamping labellers are typically used. US5,829,351 to Anderson discloses such a labeller. In Anderson, a turret carries a number of flexible pneumatic bellows about its periphery. The turret has a vacuum plenum and a positive pressure plenum. The turret rotates each bellows, consecutively, to a labelling station. A bellows normally communicates with the vacuum plenum which keeps it in a retracted position; also, due to end perforations in the bellows, the negative pressure holds a label at the end of the bellows. However, when the bellows reaches the labelling station, it is coupled to the positive pressure plenum which causes a one-way valve to block the perforations and causes the bellows to rapidly extend until it tamps a product below. The force of the tamping forms an adhesive bond between the pressure sensitive adhesive of the label and the product. Labels are fed to each bellows from a label cassette with a label web comprising serially arranged labels on a release tape. The release tape is split along a weakened centreline to release the labels.

A problem arises if products are irregularly arranged such that they do not all pass directly below the labelling station. A further difficulty faced by a tamping apparatus employing a flexible bellows is in the accurate control of tamping with the bellows. Yet another difficulty is in the synchronisation of the label web with the bellows and in the ease of re-loading a label cassette. This invention seeks to address at least some of these problems.

SUMMARY OF INVENTION

In one aspect, a target area for a given product conveyed on a conveyor is determined relative to a frame of reference. One of a plurality of labellers fixed at different transverse positions over the conveyor, which one labeller is at a transverse position which is within the transverse extent of the target area is then activated in order to label the product. In another aspect, a labeller has a flexible bellows with an interior air diffuser. The air diffuser has a central opening facing the tamping end of the bellows and at least one side opening. This arrangement can enhance the responsiveness of the bellows. In a further aspect, a labeller has a two-sided timing belt driven by a stepper motor with a de-mountable label cassette which, when mounted, has a drive pinion meshing with the two-sided timing belt. In another aspect, a labeller has a label cassette with a driven pin wheel for moving a pin holed release tape of a label web. A ratchet tooth having a fixed relation to a pin of the pin wheel engages a pawl to set a limit for driving the label web in a label web retracting direction in order to set a start position for a label on the web. It is useful to set the label cassette at this start position when the cassette is first mounted and then occasionally thereafter in order to reduce the likelihood of label mis-feeds.

Accordingly, the present invention provides labelling apparatus for use with a conveyor for conveying products in a downstream direction, comprising: a vision system for imaging products on said conveyor; a plurality of labellers downstream of said vision system, each labeller for being fixed above said conveyor at a different transverse position over said conveyor; a processor for, responsive to an input from said vision system, selecting a labeller to label a given product and sending an activation signal to one said labeller.

According to another aspect of the invention, there is provided a method of labelling products, comprising conveying products in a downstream direction, determining a target area for a given product on the conveyor relative to a frame of reference, and activating a one of a plurality of labellers positioned above the conveyor at fixed transverse positions which one labeller is within a transverse extent of the target area. A computer readable medium is also provided to effect this method.

According to a further aspect of the present invention, there is provided a product labelling apparatus comprising: at least one flexible bellows having a retracted position and an extended tamping position; an air diffuser associated with each bellows, each air diffuser extending interiorly of an associated bellows from a base of said associated bellows toward a tamping end of said associated bellows, said each air diffuser having a central opening facing said tamping end of said associated bellows and at least one side opening facing a side of said associated bellows.

According to another aspect of the invention, there is provided a labelling apparatus comprising: an indexing turret carrying a plurality of tamping labellers; a stepper motor for stepping in synchronism with step-wise movement of said turret, said stepper motor for driving a two-sided timing belt; a releasable mount for a label web cassette; said label web cassette having a drive pinion, said drive pinion for meshingly engaging with said two-sided timing belt when said label web cassette is mounted to said releasable mount.

According to a further aspect of the invention, there is provided a labelling apparatus comprising: an indexing turret carrying a plurality of tamping labellers; a label web cassette normally driven in synchronism with said indexing turret; wherein a label web of said cassette has a pin hole between each label and wherein said label web cassette has a driven pin wheel engaging said pin holes; and a ratchet tooth fixed in relation to a pin of said pin wheel and a pawl setting a limit for driving said label web cassette in a label web retracting direction whereby said label web may be retracted so that a label is at a pre-determined start position.

Other aspects and features of the invention will become apparent be reference to the following description in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the figures which set out example embodiments of the invention,

figure 1 is a top plan schematic view of a labelling apparatus made in accordance with this invention,

figures 2A and **2B** are front and side views, respectively, of a labeller which may be used in the apparatus of **figure 1**,

figure 3 is a side view detail of a portion of the labeller of **figures 2A**, **2B**,

figure 4 is a perspective view of a turret of the labeller of **figures 2A**, **2B**,

figure 5 is a perspective view, and **figure 5A** a side view, of a portion of the turret of **figure 4**,

figures 6A and **6B** are front and side views, respectively, of another portion of the turret of **figure 4**,

figure 7 is an exploded view, and **figure 7A** a side view, of a further portion of the turret of **figure 4**,

figure 8 is a plan view of a label web used with the apparatus of **figure 1**, and

figure 9 is a flow diagram for operation of a processor of the apparatus of **figure 1**.

DETAILED DESCRIPTION

Turning to **figure 1**, a labelling apparatus **10** comprises labellers **12a** to **12h** (referred to individually as labellers **12**) mounted by mounts **14** at a fixed position above a conveyor **16**. The labellers **12** are arranged as an upstream bank **18u** of labellers (**12a** to **12d**) and a downstream bank **18d** of labellers (**12e** to **12h**). Each bank **18u**, **18d** of labellers extends transversely of the conveyor **16**. The labellers in a bank are equally spaced and the labellers of the downstream bank **18d** are offset from those of the upstream bank **18u** so that each labeller has a different transverse position over the conveyor. Further, the labellers **12**

extend substantially across the width of the conveyor so as to provide eight distinct transverse positions across the conveyor. The labellers **12** are operatively connected to processor **22** on paths **20**.

The labellers **12** are downstream of a camera **24**; the camera is arranged to image an area of the conveyor and output this image to the processor **22**. In this regard, products **26** may be carried in trays **28** and the camera may image an area which captures one such tray. For example, as illustrated, the products may be vine ripened tomatoes which remain attached to vines **30** such that the products are irregularly spaced. A conveyor position indicator **32** (which, for example, may be a rotary encoder, a sensor which senses marks on the conveyor, or, where the conveyor moves at a known constant speed, simply a timer) also outputs to the processor.

A labeller **12**, in its various aspects, is illustrated in **figures 2** to **7**. Referencing **figures 2A** and **2B**, the labeller **12** has a turret **40** rotatably mounted to a base **38**. A drive belt **42** connects the turret **40** to a stepper motor **44**. A label cassette **50** is releasably mounted to base **38** by way of a loading peg **48** at the rear of the cassette which slides into a notch **52** on the base and allows the cassette to be pivoted forwardly into a releasable latch (not shown) at the front of the base.

The label cassette has a cassette magazine **54** to which is wound a label web **56** of the type illustrated in **figure 8**. Thus, the web comprises a release tape **58** carrying a plurality of labels **60** backed with a pressure sensitive adhesive. A pin hole **62** is provided in the release tape between each pair of labels. The label web extends from the cassette magazine **54** to a pin wheel **66** of the label cassette **50**, then through a C-channel member **68** to a label pick-up station **70**, with the release tape **58** returning to wind around a pin wheel **72**. Pin wheel **72** is concentrically mounted to drive pinion **74**. With the cassette **50** mounted to base **38**, the drive pinion **74** is meshed with a two-sided timing belt **78** on the base. The two-sided timing belt is driven by a stepper motor **84**. A communication path **20** from the processor **22** (**figure 1**) terminates at stepper motors **44** and **84**.

As seen in **figure 3**, pin wheel **72** has a circumferential portion **82** which carries a ratchet tooth **86** for each pin **88** on the wheel **72**. Each ratchet tooth has an operative edge **90** aligned with a pin **88**. A spring loaded pawl **92** is urged against circumferential portion **82**.

The turret **40** is detailed in **figures 4** to **7**. Referencing **figures 4**, **5**, and **5A**, turret **40** has a stationary core **110** fixed to base **38**. The core has a port **112** for connection to a vacuum source (not shown) and a port **114** for connection to a source of positive pressure (not shown). Port **112** connects to an airway having a substantially circumference channel **118** opening to the periphery of the core. Port **114** connects to an airway having a slot **120** opening to the periphery of the core between the ends of the channel **118** so as to leave lands **124** between the ends of the channel **118** and slot **120**. The core **110** is oriented so that slot **120** is positioned over a label applying station **128**.

Referencing **figures 6A** and **6B** along with **figure 4**, turret **40** has a sleeve **130** closely fit to the core **110**. Both the core and sleeve are fabricated of an ultra-high molecular weight (UHMW) polymer, or other material having a low co-efficient of friction. Thus, closely fitting sleeve **130** can rotate on core **110** absent other bearings between the two members. Sleeve **130** has a flange **132** which receives drive belt **42** (**figure 1**). The sleeve also has a number of peripheral through holes **134** comprising cylindrical openings **136** extending from its outer surface which terminate in slots **138** extending through its inner surface. A ratchet tooth **142** is associated with each through opening **134** having an operative edge **144** proximate a leading edge of its associated opening **134**. A spring loaded pawl (not shown) mounted to base **38** (**figure 2A**) is urged against the ratchet tooth bearing periphery of sleeve **130**.

Referring to **figures 7** and **7A** with **figure 4**, an air diffuser **140** has a base **142** which is press fit into each cylindrical opening **136** (**figure 6A**) of sleeve **130**. The air diffuser also has a snout **144** with a central opening **146** and side openings **148**. The air diffuser base **142** has a central opening **150** in fluid communication with the openings **146**, **148** of the snout **144**. The air diffuser has a lip **152** for mounting a bellows **160**. Each bellows **160** is fabricated of a flexible material, such as rubber or silicone, which can be stretched over a lip **152** of an air diffuser **140**. The tamping end **162** of the bellows is perforated with pin holes **164**. A one-way valve at the tamping end comprises a flexible disk **166** internally mounted

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in the bellows **160** at a small stand off from the tamping end **162** by a short post **168**. It will be noted from **figure 7A** that with a bellows **160** mounted to an air diffuser **140**, the disk **166** seats on the central opening **146** of the air diffuser when the bellows is in its fully retracted position.

To prepare labelling apparatus **10** for operation, label cassettes **50** are first readied. To ready a cassette, a full magazine **54** is loaded on the cassette then the end of the label web **56** is drawn from the magazine around pin wheel **66**, through channel **68** and back to pin wheel **72** such that the pins of each pin wheel are embedded in the pin holes of the web. So as not to waste labels during set-up, the web may have a leader portion free of labels. A readied cassette **50** may be mounted to the base **38** of a labeller **12** by inserting peg **48** of the cassette into notch **52** of the base then tilting the cassette **50** forwardly until the cassette latches to a latch carried by the base **38**. While the cassette is being tilted forwardly, pinion **74** contacts double-sided timing belt **78** ever more forcefully, deforming the belt thereby ensuring that teeth of the pinion **74** will mesh with the belt. In the latched position of the cassette seen in **figure 2B**, belt **78** is perpetually deformed by the pinion. This deformation results in the timing belt wrapping around a portion of the periphery of the pinion **74** so that a greater number of teeth of the pinion engage with the timing belt.

Next each labeller may be moved to a start position (**S210**). To do so, processor **22** signals stepper motor **84** to rotate in a direction which will wind the label web **56** back on to the magazine **54**. With specific reference to **figure 3**, stepper motor **84** then rotates in a counter clockwise direction so that pinion **74**, with its concentrically mounted pin wheel **72**, rotates clockwise. This continues until pawl **92**, which rides along periphery **82** of the pin wheel **72**, engages an engaging face **90** of a ratchet tooth **86**, whereupon stepper motor **84** stalls out as it can rotate counter clockwise no further. It will be recalled that there is a pin **88** for each ratchet tooth **86** and that the engaging face **90** of each tooth **86** has the same relative position with respect to an associated pin **88**. It will also be recalled that there is one pin hole **62** between each pair of labels on the label web. In consequence, with an appropriate choice of the distance between pin wheel **72** and the label pick-up station **70**, a label **60** will be at a pre-selected location with respect to the labelling station when the stepper motor **84** stalls. This is the start position for the labelling cassette **12**. The start position of the label cassette will normally be such that a label is present just upstream of the label pick-up

station **70**. Similarly, processor **22** may signal stepper motor **44** to rotate backwards (clockwise) until a pawl (not shown) engages the engaging face **144** of a ratchet tooth **142** on sleeve **130** of turret **40** whereupon stepper motor **44** will stall (**S212**). This defines the start position for turret **40**. The start position for turret **40** will normally be such that a bellows **160** is at the label pick-up station **70**.

If not done previously, the positive and negative pressure ports **114**, **112**, respectively, of each labeller are then coupled to appropriate air pressure sources. This couples a negative pressure to each bellows **160** of the turret **40** of a labeller thereby drawing each bellows to a collapsed position shown in **figure 4**. A bellows remains in this collapsed state except when at the label applying station **128**. This is due to the configuration of the core **110** with its substantially circumferential channel **118** coupled to the vacuum source. The lands **124** of the core substantially isolate the negative pressure in the channel **118** from the positive pressure in the slot **120** (which slot is aligned with the label applying station).

With a vacuum source coupled to a bellows **160**, the one-way disk valve **166** is open such that there is a low pressure beyond the tamping head **162** of the bellows. Thus, a bellows **160** at the label pick-up station is ready to pick-up a label. The processor then sends an activation signal to stepper motor **84** causing it to advance the label web **56** by a fixed increment. This moves a label on the web from just upstream of the label pick-up station **70** to station **70** whereat the release tape turns back on itself around the end of channel **68** causing the label to peel off. Since a bellows **160** is already at this station, the released label **60** is sucked onto tamping head **162** presenting its pressure sensitive adhesive side outwardly. The processor then activates stepper motor **44** to rotate the turret **40** by a fixed increment in advancement direction **A** (**figure 2B**) so as to advance the next bellows **160** to the label pick-up station **70** and then again activates stepper motor **84** to advance the next label to the label pick-up station. This is repeated until all bellows extending in the advancement direction **A** between the label pick-up station and the label applying station **128** are loaded with a label (as shown in **figure 2B**, this would be four bellows) (**S214**).

Conveyor **16** may be started in downstream direction **D**. The conveyor may hold a number of trays **28**, each loaded with products **26**. When a tray reaches an imaging station, camera **24** images the tray and its contents. This image is passed to processor **22** (**S220**) as is a

conveyor position indication signal from position indicator **32** (**S222**). The received image of the products **26** (and the vines **30**) on the tray **28** allows the processor to determine the co-ordinates of a target area for labelling a product (i.e., the processor determines this target area relative to a frame of reference). Based on the determined target area, the processor determines which labeller **12** has a transverse position over conveyor **16** which is within the transverse extent of this target area. This labeller is chosen to label the product (**S224**). For example, the processor **22** may determine that a target area of product **26a** can be hit by labeller **12h** of bank **18d** and so choose labeller **12h** for labelling product **26a**. Similarly, the processor may determine that labeller **12b** of the upstream bank **18u** should label product **26b**. The distance between the imaging station and each bank **18u**, **18d** of labellers is pre-defined and stored in the processor **22**. With knowledge of this, the movement of the conveyor, and the image of the products on the tray, the processor may determine when the target area of any product **26** on the tray **28** will reach the label pick-up station **70** of each bank **18u**, **18d** of labellers. Having chosen a labeller **12** for a given product **26**, the processor **22** can then time the sending of an activation signal to stepper motor **44** of the chosen labeller so that a label is applied to the given product (**S226**).

More particularly, the activation signal sent by the processor to stepper motor **44** advances the stepper motor **44** by one step to move a bellows **160** which had previously been loaded with a label through the label applying station. While moving through the label applying station, the bellows **160** registers with slot **120** in core **110** thereby coupling the source of positive air pressure to the air diffuser **140** of the bellows **160**. As air attempts to push out of the air diffuser into the bellows, air is initially blocked from exiting central opening **146** in the snout **144** of the air diffuser in view of disk **166** of the bellows blocking this opening. Consequently, initially, most air is directed out of the side openings **148** of the snout **144**. This air fills the vacuum in the bellows. Meanwhile, the air pressure will seat disk **166** against the pin holes **164** in the tamping end **162** of the bellows to block these perforations. With the vacuum in the bellows replaced by a positive pressure, the bellows quickly extends until it tamps the product at the labelling station **128**, thereby applying a label to the product. As the tamping bellows moves past the label applying station **128** it is again coupled to a source of vacuum which quickly draws the bellows back to its collapsed position. At the end of the step by the stepper motor **44**, another bellows **160** will have advanced to the label pick-up station **70**. The processor may then cause the stepper motor

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84 of the label cassette **50** to advance another label to the label pick-up station in order to load the bellows now at this station (**S228**), and the process may repeat.

Processor **22** may be loaded with software from computer readable medium **34** in order to perform the described operations. Computer readable medium **34** may, for example, be a disk, a solid state memory device, or a file downloaded from a remote source.

From the foregoing, it will be apparent that each step of stepper motor **44** moves one bellows **160** on turret **40** through the label applying station **128** and stops the turret so that another bellows is registered with the label pick-up station **70**. The speed of the stepper motor may be adjusted so that a bellows moving through the label applying station is coupled to the source of positive pressure air for an appropriate length of time.

In consequence of air pressure initially being communicated to the bellows through the side openings of the air diffuser **140**, the bellows will contain a positive pressure when it begins its tamping motion. This makes the tamping motion faster and more predictable.

When a magazine **54** of a cassette **50** is spent, the cassette **50** may be removed, re-loaded, and replaced.

It will be apparent that the processor **22** may control banks of fixed labellers other than tamping labellers **12** in order to select a labeller to apply a label to a product. Thus, in a modified system, bellows labellers **12** may be replaced with piston-type tamping labellers (such as the labellers described in US5,645,680 to Rietheimer, the contents of which are incorporated by reference herein). In such case, processor **22**, working with camera **24** and position indicator **32**, may send activation signals to the piston-type tamping labellers. Further, where the products were such that a wiping labeller would suffice, bellows labellers **12** could be replaced by labellers which wipe a label onto a product.

While the labelling apparatus **10** has been illustrated as having two banks of labellers, with sufficiently narrower labellers, one bank may suffice. Further, to provide a smaller granularity between transverse positions of the labellers, additional banks of labellers could

be provided, with each labeller having a smaller transverse offset from transversely adjacent labellers.

Where the conveyor position indicator is simply a timer, it may be incorporated in the processor **22**.

Although the stepper motors **44**, **84** have been described as being electronically controlled by processor **22**, alternatively, they could be mechanically, or electro-mechanically controlled. For example, an overhead deformable finger could be located at a fixed position upstream of each labeller such that the finger is deformed when a product contacts it, resulting in a microswitch temporarily closing. This could activate a timer which, when it times out, sends a signal to the associated labeller causing it to execute a tamping operation and re-load a bellows with a label. Once the timer times out, it is re-set. If the conveyor speed was fixed, each timer could be loaded with an appropriate value based on this speed and the distance the finger was positioned upstream of the associated labeller.

Other modifications will be apparent to those skilled in the art and, therefore, the invention is defined in the claims.